

MINISTRY OF
LABOUR AND NATIONAL SERVICE
FACTORY DEPARTMENT

Third Report of Proceedings of the
Joint Standing Committee on

Safety in the Use of
Power Presses

LONDON
HER MAJESTY'S STATIONERY OFFICE
1957

INTRODUCTION

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importance of competence in safety matters amongst
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performance of Arrestor Brakes has been prepared
: British Power Press Manufacturers' Association.

: has been set up to make recommendations in
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to be employed more widely on small and medium
s of the interlocking type are used, and it is felt
ld be made to specify appropriate principles aimed
dards of safety.

To H.M. Chief Inspector of Factories

SIR,

Maintenance of Presses

1. In the Report of the Committee on Safety in the Use of Power Presses* which was published in 1945, reference was made to the importance of effective maintenance of presses, and certain recommendations were made. Paragraph 25 read as follows:

"Where a static fixed guard or a completely effective automatic guard is employed, it may be said that the causation of any particular stroke is, strictly speaking, a matter of no moment so far as the operative is concerned, for he is completely protected against injury by the tools. The interlocked fixed guard, however, raises new considerations, for it is intimately bound up with the actuating mechanism of the clutch, and its effectiveness depends upon its having a "safety response" to every vagary of the press. It becomes increasingly important, therefore, that the press clutch and its associated gear shall be subject to efficient maintenance and inspection. It is a fact, not we think always recognised, that the positive type clutch is a mechanism subject to shock loading, and particularly heavy wear inherent to the construction and means of operation, in addition to the conditions of fatigue associated with all machinery having a cyclical system of working. It is well recognised by industrial experience that mechanisms subject to such conditions cannot be assured of a reliable performance unless they are subjected to periodical examination. We are of the opinion that every press should be examined and tested, whilst in use, by a competent person once in every period of six months, and it should be an obligation upon the occupier to have a thorough examination made if the competent person is of the opinion that the condition of the press needs such an examination in order to ensure safety. All stress-bearing parts, such as keys, extractors, and extractor mountings, should be subject to the thorough examination to which we have referred in order to check wear and damage. In addition to these examinations all guard and interlock mechanisms should be tested daily for effective performance by a competent mechanic. It is important in connection with these examinations and tests that proper records should be made; we feel that this matter is sufficiently important for statutory force to be given to Regulations prescribing, *inter alia*, standards of inspection and tests of presses".

2. Since the publication of the above-mentioned Report, observation of conditions in factories and investigation of accidents has confirmed what was then said in regard to the need for systematic maintenance and inspection. A few firms have operated schemes of maintenance on a voluntary basis, and have found that, apart from questions of safety, enhanced reliability from a production standpoint is achieved. On the other hand, it is clear that in a large portion of industry using power presses very little is done, or at the best, arrangements are haphazard.

*Report of the Committee on Safety in the Use of Power Presses 1945. Published H.M.S.O. 3s. 6d.

From time to time, instances come to light of fractured extractors or extractor pivot pins, or detachment of essential parts from clutch mechanisms. It is known that many breakdowns having a substantial operator risk factor, take place fortunately without accident, but injury might equally well have resulted but for the chance that the operator happened to be clear at the time of the dangerous occurrence. We have concluded, therefore, that we ought to reaffirm the strong recommendation previously made to you that the time has arrived for the introduction of statutory Regulations to deal with this question of maintenance. We have followed the recommendation of the 1945 Committee that thorough examinations of presses, and of guards, should take place at six monthly intervals, and we include in Appendix A a draft of the proposed Regulations. These Regulations deal also with certain aspects of training which are referred to below.

3. We are of the opinion that the purchaser of a new press and guard should have an assurance that both the machine and its safety device are in a fit and effective order for safe working. We have provided, in our proposed draft, for the issue of certificates to meet this point. A corollary of this concerns the sale of secondhand presses, of which there is a considerable volume of business. It has been found, following the investigation of accidents, that secondhand presses are sometimes sold in an unsatisfactory mechanical condition; in many cases moreover they are fitted with out of date or ineffective guards. We feel that it is highly unsatisfactory that such a state of affairs should continue and we wish to place on record our view that persons concerned in the sale of secondhand presses should not sell these machines unless the presses are in sound mechanical condition having regard to operator safety. As for the guards, we do not think that a secondhand guard should be sold unless the maker of the guard or other competent person has ensured that it is appropriate to the press and in satisfactory mechanical condition. Our view is that in every case, whether new or secondhand, machines and guards should be subject to thorough examination in the occupier's factory by a competent person and that following such examination all necessary steps should be taken to ensure that both machines and guards are in effective working order before being put to use.

4. We have taken note of the fact that in a few instances photo-electric or other electrical safety devices form part of the safety arrangements, and it has been pointed out to us that the effective examination and servicing of such apparatus may involve highly skilled and particular qualities of competence; appropriate reference has been made to this in the proposed Regulations.

5. In an earlier Report* we recorded an agreement with the British Power Press Manufacturers Association in regard to certain constructional standards for new presses, and inter alia, it was agreed that there should be marked the maximum permissible flywheel speed and the direction of rotation of the flywheel. Since that agreement was made, we understand that there are developments in the direction of variable flywheel speeds for given machines and it has been suggested that there should be a modification to this recommendation. Accordingly we recommend that in the proposed Regulations it should be a requirement that new presses should be marked with the flywheel speed, as recommended by the maker, for normal usage.

6. We feel that any system of regular maintenance and inspection should be supported by proper records, and while we have no wish to overburden industry

*Second Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses. Published H.M.S.O. 1/-.

with more elaborate forms, we are satisfied from what has been done in a number of instances that the keeping of records constitutes an extremely valuable means of bringing weaknesses to light, and does ensure the proper appreciation of the importance of this subject.

Training of Personnel

7. In our Second Report* we referred at page 5, and in Appendix IV, to experimental courses in the training of tool setters, which had been set up in Birmingham in 1951/1952. We are very glad to report that this scheme of training in Safety has become a permanent feature established at the Safety Training Centre under the management of the Birmingham Industrial Group of the Royal Society for the Prevention of Accidents within the buildings of the Museum of Science and Industry, Newhall Street, Birmingham. By the end of 1954, 1,003 tool setters and other personnel from 612 industrial concerns had attended the two-day courses, which are held at approximately monthly intervals. The Training Centre is equipped with a representative collection of power presses and of interlocking guards, together with many photographs and other equipment. The courses form a most valuable means of discussion amongst those attending, and the interchange of views and experience is almost as valuable as the knowledge which is imparted by lectures and demonstrations. The keen readiness of the trainees to engage in free discussion on their problems has been a valuable feature. On return to their places of employment these men have been able to impart a new outlook to power press safety, and we feel that this work should be carried on, and that recognition should be given to it by statutory requirements. Accordingly, in the proposed Regulations in Appendix A we have included clauses which will require that persons employed to "set up" presses for use will be competent to set and test the safety devices. This competence is to be dependent first of all upon effective training, and to this end it is proposed that a schedule of principles to be included in training should be attached to the Regulations. We have taken the opportunity to recommend that the setting of power presses should not be undertaken by persons under the age of 18 years, subject to a permissive arrangement whereby a person under this age who is undergoing training may be employed provided he is under the direct supervision of a person who is himself competent.

8. In accordance with our custom we have conducted a review of accidents in the industry. While we are glad to see evidence of progress in the prevention of accidents, as shown by the fall between the years 1947 to 1953, we have to record with regret a substantial increase in 1954, when the total of tool and die accidents rose to 291. The encouraging figures up to 1953 shown in the chart in Appendix B, therefore, afford no reason for undue optimism, and we wish to emphasise that reduction of accidents can only be achieved by the utmost attention to maintenance of effective standards of fencing, the design of safe forms of tools aimed at eliminating hand entry to danger areas, and training of workers. In our view, the proposed Regulations are likely to be the most effective means of achieving that improved standard which is necessary to reduce accidents. The worst feature is the fact that the total number of accidents at tools which were not fenced has remained substantially constant at about 130 each year. The reasons for the absence of a guard at the time of an accident have been examined, and the position as far as 1953 was concerned was as follows:

*Second Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses. Published H.M.S.O. 1/-.

Accidents at Presses without Guards

Tool Setting (setting and resetting)	14
Tool Setting (trying out)	25
Guards available but not used	34
Guards not provided (includes 2 cases where only hi-manual controls were in use)	52

The first two items in this table reflect the fact that many tool setters engage in their work without taking the proper precautions or observing the legal requirements. The trying-out of tools of a press, e.g taking of trial pressings, is an operation not different in the main from operating a press for production purposes, the danger is the same and there is an obligation to fence. As for setting and resetting, it is important that the possibility of the press coming into motion while this is being done should be prevented absolutely. The cases where guards were available but not used include those where there was ignorance or carelessness as to the necessity for being insistent on the use of guards or where, under otherwise satisfactory conditions, some oversight had occurred and an operator had worked on an unfenced press. The entire absence of a guard is a serious omission in these days when the dangers of power presses are so widely recognised, but not infrequently H.M. Inspectors visit factories, large and small, where a press is being used entirely unfenced just because the occupier or those responsible to him are more intent upon getting production from a machine than on ensuring the safety of those who operate it.

9. The reduction in the number of accidents where fixed guards were in use is considered to be due partly to an improvement in the standards of these devices and partly to a greater use of interlocking guards, which have been increasingly adopted in cases where fixed guards of doubtful efficiency have been previously used. It is well known that fixed guards, to be effective, must receive thoroughly detailed attention in design. Three important factors are, for example, secure fixing, substantial construction and prevention of access to danger from any direction. Otherwise good guards have failed through lack of attention to one or more of these points.

10. The reduction in the number of accidents where interlocking guards were in use, in the period 1951 to 1953, might be thought to be an indication that in spite of increasing numbers of these guards their features were becoming better understood and that they were in general being maintained in better order. While there is no doubt some truth in this it is nevertheless the fact that cases are often found where maintenance is poor and the dangerous condition of such guards is not recognised by the users. Many interlocking guards are now more than ten years old and in that time there have been improvements in design, such as were referred to in our First Report of Proceedings. Users should take stock of the condition and age of their guards and have them altered or replaced where necessary to ensure that they are of the best modern standards of design and construction. In our previous reports we advocated the general adoption of sequential operation. Since then there has been increasing adoption of the principle and this has, in our opinion, made a substantial contribution to the establishment of safer conditions.

11. The reduction in the number of accidents where automatic guards were in use is a reflection of the gradual disappearance of this type of safety device on those presses for which it is not suitable.

12. In our First Report of Proceedings* we referred to the development of arrestor devices, which had as their object the prevention of uncovenanted strokes arising from certain types of machine breakdown. Since the publication of our Report one manufacturer of presses has installed considerable numbers of these devices, supplying them with new machines. Two guard makers also have designed and fitted arrestor brakes in substantial numbers to new and existing presses. In view of the desire that interlocking guards should be permitted to open at a point earlier than the end of the press return stroke, we have considered whether the arrestor brake could contribute to the solution of the problems presented by this "early opening" feature. In order to deal with this aspect adequately we considered that we ought to attempt the preparation of a specification of performance for arrestor brakes. The Technical Sub-Committee held a number of meetings to consider this matter and has prepared the specification of performance which we include as Appendix C. It now appears practicable to design and fit arrestor brakes to presses of high tonnages but we must again emphasise the importance of ensuring that arrestor brakes are not fitted to presses structurally unsuitable. In order that this reservation should be effectively covered, we have included a clause requiring every arrestor device to be subject to a performance test under load by the maker, who should then issue a certificate of test stating the speed at which the test was carried out. Any subsequent proposed increase of speed should be contingent upon a further test and certificate. A further important point in the specification is that when an arrestor device operates it is evidence of a fault in the mechanism of the machine. We think that, where such an occurrence takes place under a severe load, i.e. such a load as is imposed when the clutch is in engagement, a report of the circumstance and investigation should be submitted to H.M. District Inspector of Factories. In other words, we feel that occurrences of this kind should be viewed in the same light as those which are subject to a legal requirement to be reported under the terms of the Dangerous Occurrences (Notification) Regulations, 1947.

13. The terms of the Specification have been communicated to the British Power Press Manufacturers Association with the suggestion that the members of this body should give consideration to the devising of arrestor brakes for their respective designs. Subject to a point of detail the Association has given its approval to the Specification.

Early Opening Guards

14. It has been pointed out by many interested people that the conventional interlocking guard which remains closed throughout the full cycle of the press imposes certain limitations on production rates because the operator is anxious to reach in to the danger area at the earliest possible moment. There is in consequence a case for suggesting that guards should open at or immediately after the commencement of the return stroke so that as the tools open the operator may have access to them. We have given consideration to the conditions under which guards of the interlock type on positive clutch presses may open in this manner, and two methods have been examined. The first is to provide an arrestor brake of such a character that there is no possibility of the press making a repeat or uncovenanted stroke. With such an arrangement, the interlocking guard will prevent clutch

*First Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses. Published H.M.S.O. 9d.

extractor movement until the guard is closed and the guard will remain closed until the end of the closing stroke. After this point it is allowed to open and the arrestor brake will be free to operate. Where a press is fitted with an arrestor brake complying with the Specification of Performance, then we feel that the early opening interlocking guard is permissible.

15. The second method is one in which interlocking and automatic actions are combined. We have examined a guard based on this method, which is illustrated and described in Appendix D. The limitations of automatic guards have been dwelt upon at great length on many occasions, in particular in the Report of 1945, and we feel unable to depart from what was there said. There is, however, a range of presses with strokes of 7 inches to 10 inches, some of which are operated by positive clutches, and whose speed is such that an automatic guard action can be successfully used. By a combination of interlocking and automatic actions, the operator is prevented from making an ordinary stroke of the press until the guard is in the closed position, and is safeguarded against the risk of trapping during a repeat or uncovenanted stroke by the automatic action.

Press Balancing

16. From time to time there have been discussions of the merits of press balancing as a means of contributing to safety, in particular in regard to the question of over-running, where guards of a non-automatic type are fitted. We have decided that this matter is of some importance and after obtaining certain information as to balancing practice by individual makers we have concluded that it would be advisable for the Technical Sub-Committee to investigate and report. In the meantime we would be glad to hear of any proposals aimed at preventing involuntary strokes additional to the means normally provided.

17. We have received reports relating to faults in electro-pneumatic control systems of presses in cases where reliance was placed on guards controlling the electrical system. We have felt that these occurrences merit a review of methods of control of such presses, and H.M. Chief Inspector has set up a special Sub-Committee to examine the whole problem and to report to us. The membership of this Committee is as follows:

R. Bramley-Harker, Esq., *Chairman.*

W. H. L. Brogden, Esq.	T. Pattison, Esq.
N. Elliott, Esq.	E. C. Seed, Esq.
W. F. Fellows, Esq.	J. D. Udal, Esq.
J. F. Millard, Esq.	P. Zierold, Esq.

R. K. Mawson, Esq., *Secretary.*

Signed:

T. W. McCULLOUGH, *Chairman*
R. BRAMLEY-HARKER
W. H. L. BROGDEN
H. D. CHALLEN
N. ELLIOTT
JOHN R. MOORE
A. L. STUCHBERY
J. D. UDAL
R. K. MAWSON, *Secretary.*

APPENDIX A

The Power Presses (Maintenance of Machines and Safety Devices) Special Regulations, 19--

Preamble

1. SHORT TITLE, COMMENCEMENT AND INTERPRETATION

2. APPLICATION.—These Regulations shall apply to all factories in which power presses are used.

DEFINITION.—“Power Press” shall include a press brake and any machine normally connoted by the term whatever the source of power.

“Prescribed” means prescribed by the Minister of Labour.

“Approved” means approved by the Chief Inspector of Factories.

3. No person shall be employed to set the tools of a power press or otherwise to prepare a power press for use by any person unless:—

- (a) he has attained the age of eighteen;
- (b) he has been effectively trained in the following duties, viz., the use, testing and adjustment of the guards and other safety devices used on, or in connection with, power presses in use in the factory and provided in pursuance of Section 14 of the Factories Act, 1937. No person shall be considered to have been effectively trained unless as a minimum he has received instructions in accordance with the Schedule appended to these Regulations and has shown to the satisfaction of the occupier that he understands the significance of the matters in which he has been instructed ;
- (c) he is competent to carry out the said duties at all times while so employed in the factory;
- (d) he has been appointed in writing by the occupier on the prescribed certificate for carrying-out the duties specified in paragraph (b) above, which certificate shall indicate any limitations of his duties. Each person so appointed shall be furnished by the occupier with a copy of the *prescribed* certificate of his appointment.

Provided that this Regulation shall not preclude the employment of a person over sixteen years of age in the processes referred to, being a person undergoing training in the work of toolsetting and acting under the direct supervision of a person appointed in accordance with this Regulation.

4. Suitable arrangements shall be made for:—

- (a) the effective training by a competent person of each person proposed to be appointed in writing under paragraph (d) of Regulation 3, in the duties specified in paragraph (b) of that Regulation;

- (b) ensuring that each person who has been trained and appointed as required by the foregoing provisions carries out the duties specified in paragraph (b) of Regulation 3, in the proper manner.

Provided that paragraph (a) of this Regulation shall not apply to a person who produces evidence to the satisfaction of the occupier that he has been effectively trained elsewhere than in the factory in the said duties and particulars of such training shall be entered on the *prescribed certificate* of appointment of the person concerned.

5.

- (a) Every power press shall be thoroughly examined by a competent person once at least in every period of six months. No power press shall be used for the first time in any factory unless it has been thoroughly examined by a competent person. In the case of a new power press which has not been previously used, a certificate by the maker certifying that the machine on completion was in mechanically sound condition and in effective running order shall be acceptable for the purpose of this Regulation.
- (b) Where, in pursuance of Section 14 of the Factories Act, 1937, secure fencing or other device is provided, which is of such a nature as to embody moving working parts; the thorough examination required by paragraph (a) of this Regulation shall extend to such secure fencing or other device.
- (c) When in pursuance of Section 14 of the Factories Act, 1937, a photoelectric or other electrical safety device has been provided the thorough examination required by Regulation 5 (a) shall include the mechanical parts and in addition the electrical and electronic equipment, and this examination shall be made by a person or persons appropriately competent for the purpose of the Regulation.
- (d) Any defect disclosed by such examinations as are required by paragraphs (a), (b) and (c) of this Regulation shall be rectified before the power press is again put into use, provided that where the competent person is satisfied that any specified repairs may be deferred without risk to workpeople for a period of time as determined by him and entered in the Register of Examination, the power press may be put into use pending the completion of the specified repairs but may not be used after the expiration of the said period of time unless the specified repairs have been completed.
- (e) A report of the result of every such examination as aforesaid shall be made by the competent person within fourteen days of his completion of the examination in a Register of Examinations kept in the *approved form*, and a record of remedial action taken in respect of any defects disclosed, shall also be recorded in the Register.

6.

- (a) After each resetting of the tools and dies for use in a power press and before production is begun, an examination and test shall be carried out by a competent person of the safety device provided in pursuance of Section 14 of the Factories Act, 1937, and of any parts of the press mechanism directly connected with and concerned in the efficient working and maintenance of the safety device.
- (b) If after resetting the tools and dies in any power press, the power press continues in use beyond the working shift during which the production was

begun, a similar examination and test as required by paragraph (a) of this Regulation shall be carried out within the first two hours of each subsequent shift during which the press is used.

- (c) A record of such examinations and tests as are required by paragraph (a) and (b) of this Regulation shall be kept in the *approved form* and shall be retained for at least six months after completion and shall be available for inspection by any of H.M. Inspectors of Factories.
- (d) A power press shall not be used until any defect disclosed by the examination required by paragraphs (a) and (b) of this Regulation has been rectified and the power press and safety device have been certified as being in efficient working order by the competent person by signed entry in the record of examinations and tests required to be kept under paragraph (c) of this Regulation.
- (e) The record or a true copy thereof of examination and test required to be made by paragraph (c) of this Regulation shall be kept available for inspection by any persons at the power press to which it relates until the period covered by the record has been completed.

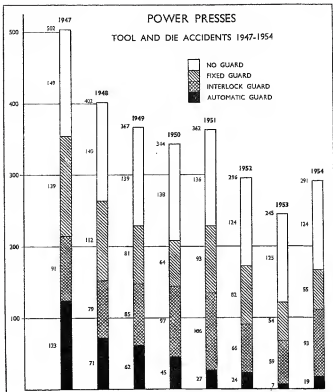
7. Each press and the guard or safety device used in connection with it shall be distinctly marked so as to enable the corresponding records of examination and tests to be readily identified.

8. Every press constructed after the coming into force of these Regulations shall have plainly marked upon it the maximum permissible flywheel speed as certified by the maker, and the direction of rotation of the flywheel.

APPENDIX B

POWER PRESSES

TOOL AND DIE ACCIDENTS 1947-1954



APPENDIX C

TECHNICAL SUB-COMMITTEE

Arrestor Devices for Power Presses

1. This Report describes experience up to date, and makes recommendations as to standards of performance. It does not deal with applications, which of necessity must be related to tooling conditions. Such matters are to be the subject of a separate report.

2. An *Arrestor-Device* is defined as follows:—

A device, attached to or incorporated in a power press, which is capable of bringing to rest the moving parts of the press, within the limits specified below.

3. Two forms of arrestor have been used on power presses:

Type (a) That embodying a frictional slip arrangement in the flywheel in conjunction with a positive stop.

Type (b) That which arrests the whole of the moving system by absorption of energy during a small proportion of slide movement.

4. Careful consideration has been given to arrestor devices of type (a), and it has been concluded that they are not likely to be acceptable by reason of the severe limitations on press capacity imposed by such an arrangement.

5. Devices of type (b) have been made in substantial numbers and there is sufficient experience with them to enable us to make recommendations as to standards of performance. These recommendations permit the use of an arrestor device which does not take care of certain eventualities occurring beyond the point at which the arrestor is applied, e.g. fracture of slide suspension members. Failures of this kind are infrequent and accidents resulting therefrom are extremely rare. Reference to these failures is made in paragraph 6 of the 1945 Report. Experience since that Report was published confirms our view that the recommendations now made give a reasonable standard.

The following table gives particulars of presses to which arrestor devices have been successfully applied:

<i>Type of Press</i>	<i>Type of Arrestor</i>
KEY CLUTCH PRESSES	
Presses of nominal capacities 6 to 100 Tons geared and ungeared.	Intensifier on normal crankshaft-mounted brake according to the design of Messrs Taylor and Challen Ltd.
Presses of nominal capacity up to 100 Tons geared and ungeared.	Arrestor embodying a separate arresting device according to the design of Messrs. J. P. Udall Ltd.

Presses up to 450 Tons capacity. Intensifier on normal clutch shaft-mounted brake.

6. The operation of an arrestor device is evidence of a fault in the mechanism of the press. In such a circumstance the press should not be run again until a full investigation of the occurrence has been made and appropriate remedies applied. Where operation takes place under a severe load, a report of this investigation should be submitted to H.M. District Inspector of Factories.

7. The following recommendations are made for a specification of performance:

(1) When a guard operates in conjunction with an arrestor device the arrangements shall be such that the arrestor device will be in an effective condition to operate at all times other than when the guard is closed and preventing access to the danger area.

(2) The arrestor device shall ensure that when operated at a speed not exceeding that at which the test required by Clause 7(6) was carried out the slide (or slides) shall be brought to rest within a distance from the top of the stroke of not more than 10 per cent. of the stroke or $\frac{3}{4}$ in. whichever is the lesser.

(3) The arrestor device shall be so constructed and applied to or incorporated in the press as to ensure that it will absorb and dissipate all the energy of the moving parts of the press including the driving motor without resultant material damage to itself or to any part of the press.

(4) The device shall be so arranged that, after it has operated, it must be restored to its initial condition before the press can be operated again.

(5) Precautions shall be taken to ensure that friction surfaces cannot be impaired by intrusion of oil or grease.

(6) Each arrestor device shall be subjected to a performance test under load by the maker, and a certificate of the test, stating the speed at which the test was carried out shall be supplied to the occupier. If subsequently the speed of the machine is increased, a further test shall be made and certificate supplied.

(7) Every press fitted with an arrestor device shall be provided with a suitable means to prevent fall-back of the crankshaft.

8. (1) It is the occupier's duty to test and maintain the arrestor device, in accordance with the makers' recommendations.

(2) A press fitted with an arrestor device shall not be run at a speed exceeding that specified in the last certificate furnished in accordance with clause 7(6).

APPENDIX D

TECHNICAL SUB-COMMITTEE

Guard Combining Interlocking and Automatic Guard

1. The guard described was developed at the works of Pressed Steel Company Limited, Oxford, and is illustrated in photographs attached to this Report. The prototype guard embodied completely mechanical action. In the guard developed from the prototype, pneumatic action for clutch actuation has replaced the corresponding mechanical action.

2. Press

The guard was fitted to a Bliss No. 28 press. This is a single action, single geared press with 8 in. stroke. The press is operated through a rolling key clutch.

3. Function

The guard embodies the following features which affect safety considerations:

- (i) Interlocking of the clutch.
- (ii) An automatic action to clear the hand from danger in the event of an uncovenanted stroke.
- (iii) Sequential operation.

4. Operation of Guard

A screen guard is suspended by side arms and suitably guided so as to impart an approximately vertical movement. It rises to close off access to the tool area. A rocker arm positively connected to the guard, interlocks with a member whose movement is related to that of the extractor so that until the guard attains the closed position, the extractor cannot move to the clutch engaging position. The interlock further ensures that until the extractor has returned to the full disengage position the guard cannot open. On attaining the closed position, a further small movement of the guard operates a valve to actuate an air cylinder whose piston is attached to the extractor operating rod, thus engaging the clutch.

A further locking effect on the guard is imposed by a lever at the left hand side of the press, the lower end of which moves into engagement with a member attached to the guard suspension arm. The upper end of the lever is associated with a cam on the crankshaft in such a way that at the bottom of the stroke, the lever is moved to release the guard. The extractor has by this time returned to the position of clutch disengagement. There is therefore freedom to open at the end of the downstroke.

An automatic action is imparted to the guard by means of a roller and lever system derived from the ram. In the event of the ram descending without the normal clutch engagement sequence or by reason of fall of the ram (as by detach-

ment from the pitman) the automatic action causes the guard to rise with the intention of removing a hand to safety should it be between the tools. This mechanism is necessarily adjustable because the driving member is attached to the ram.

5. *Standard of Performance*

This guard will provide a satisfactory standard of safety if it complies with the following requirements:

(i) INTERLOCKING MECHANISM

The interlocking of the clutch extractor should be of a standard equal to that required on fully interlocked guards, as contained in the Report of the Committee on Safety in the Use of Power Presses published in 1945.

(ii) GUARD CONTROLLING DEVICE

A device independent of the extractor interlock should be fitted which will ensure that the guard will remain in the closed position until the completion of the downstroke.

(iii) AUTOMATIC ACTION

The guard should be designed and adjusted so that it will operate as an automatic rising screen guard giving a performance not less than that contained in Appendix VI of the First Report of the Proceedings of the Joint Standing Committee dated 1950.

(iv) SEQUENTIAL OPERATION

Clutch actuation, where arranged so as to be achieved by movement of the guard, should be derived directly from a part of the guard screen or frame.

(v) PREVENTION OF FALL BACK

The press should be provided with an effective device to prevent fall-back of the crankshaft.

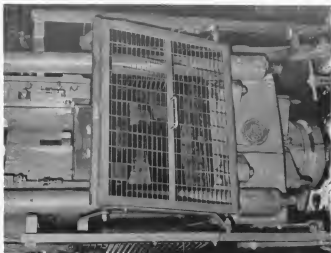


Fig. 2. Guard closed.

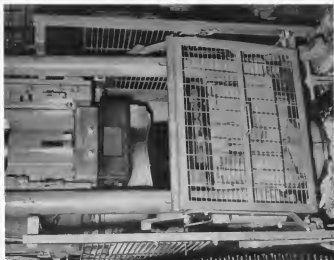


Fig. 1. Guard open.

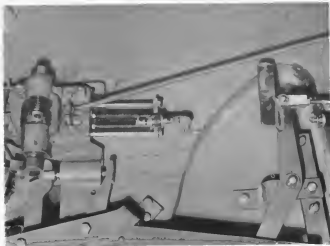


Fig. 4. Detail of plunger and lever which transmits extractor movement to bell crank lever.



Fig. 3. Detail of interlock between rocker arm connected to guard, and bell crank moved by extractor. The guard is open and the extractor cannot move from the clutch disengagement position.



Fig. 5. Detail showing bell crank moved into guard locking position by extractor movement.



Fig. 6. Device to lock guard in closed position until end of downstroke.

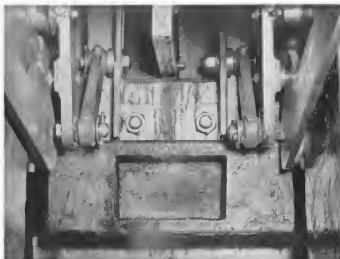


Fig. 7. Mechanism at rear of slide for imparting automatic action to guard.